



Innovative Partnerships Program

Air Pollution Control Technology

NASA Kennedy Space Center (KSC) has recently entered into an exclusive license agreement with FMC Corporation (FMC) to commercialize its Air Pollution Control Technology for the removal of nitrogen oxides from stationary combustion sources. The Air Pollution Control Technology method was developed by researchers at KSC and the University of Central Florida and utilizes the injection of hydrogen peroxide into the gas stream for rapid gas-phase oxidation of nitrogen oxide to nitrogen dioxide, which can subsequently be converted to water-soluble nitrous acid and nitric acid. The nitrogen acids may then be removed from the oxidized gas stream by wet scrubbing with a water-based absorption process or dry scrubbing with an alkaline sorbent. FMC recently entered into a Joint Collaboration Agreement with Indigo Technologies Ltd. to optimize and commercialize the Indigo MAPSystem, a unique multiple air pollutant control system. FMC and Indigo Technologies believe that utilizing the KSC technology in conjunction with the Indigo MAPSystem offers power plants and other industrial processors a low-capital approach for controlling nitrogen oxide emissions.



Success Highlights

- The KSC Air Pollution Control Technology has been successfully tested at the lab-scale at 200 cubic feet per minute.
- The KSC Air Pollution Control Technology has received a U.S. Patent #6,676,912.

Advantages

- The KSC Air Pollution Control Technology has the potential to be more cost-effective and economically feasible than currently available technologies.
- A variety of new regulations over the next five years will require coal-fired power plants to address nitrogen oxide abatement.

NASA success story

The Market

Researchers at NASA and the University of Central Florida have determined that the injection of hydrogen peroxide effectively oxidizes nitrogen oxide to nitrogen dioxide, and nitrogen dioxide to nitrous acid and nitric acid. These oxides of nitrogen are much more soluble in water than nitrogen oxide and therefore may be more easily scrubbed from the flue gas by a water-based absorption process, or as is the case with the Indigo MAPSystem, dry-scrubbed with an alkaline sorbent. In laboratory demonstrations more than 90 percent of nitrogen oxides was removed.

The economic feasibility of hydrogen peroxide the injection-scrubbing method was compared to that of the selective catalytic reduction (SCR) method of nitrogen oxide removal for a design base case and a variety of alternative cases. The hydrogen peroxide injection method was found to be more economically feasible than the SCR method, particularly for smaller coal-fired power plants generating less than 500 megawatt-hours (MWh).

Coal-fired electric power plants provide much of the electricity used in the United States. According to the latest *Electric Power Annual* published by the Department of Energy, almost 2 billion MWh of electricity was generated from coal in 2006. An increase in required installations of new pollution control equipment accounts in part for a decline in emissions of nitrogen oxides and sulfur dioxide. Nitrogen oxide emissions dropped by 4.1 percent between 2005 and 2006. Sulfur dioxide emissions decreased by 7.9 percent during this same time period. Coal-fired generating capacity with equipment for removing sulfur dioxide (flue gas desulfurization units, also referred to as scrubbers) increased by 26.1 percent between 1994 and 2005.

Commercial Applications

A new wave of emissions regulations is about to impose unprecedented challenges on United States fossil-fired generation plants, and many power companies are hard at work installing NOx control hardware. The new emissions legislation that power generators now face ranges from newly designated Non-Compliance Zones in urban areas to regional initiatives in the West.

FMC believes that the patented KSC Air Pollution Control Technology can be coupled the Indigo MAPSystem to provide a simple, low-cost way for the power industry to comply with regulations that will be phased in over the next several years in the United States.

The commercial success of the KSC Air Pollution Control Technology is the result of NASA's technology transfer program under the Innovative Partnerships Program. This program seeks to stimulate commercial use of NASA-developed technologies. If your company is interested in learning more about the NASA technology transfer process, please contact:

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